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## OTOLOGICAL REVIEW.

By CLARENCE J. BLAKE, OF BOSTON.

1. C. UTZ. Beitrag zur Histologie der häutigen Bogengänge des menschlichen Labyrinths. E. Stahl, München, 1875.
2. E. ZUCKERKANDL. Anatomische Notiz über die Tuba Eustachiana eines Elephas Indicus. *Monatschr. für Ohrenheilk.*, Sept., 1875.
3. N. RÜDINGER. Die Fossa jugularis und ihre individuelle Größenverschiedenheit. *Monatschr. für Ohrenheilk.*, Jan., 1875.
4. T. DWIGHT. Seventh Semi-Annual Report on Progress in Anatomy. *Boston Med. and Surg. Journal*.
5. C. NICOLADONI. Beobachtung am Lebenden über die Bewegung der Tuba Eustachii. *Monatschr. für Ohrenheilk.*, Aug., 1875.
6. C. MICHEL. Neue Beobachtungen über das Verhalten der Rachenmündung der Tuba und über die Thätigkeit der Muskulatur des Schlundkopfes. *Berliner Klin. Wochenschrift.*, Oct., 1875.
7. J. BERNSTEIN. Les Sens. Bibliothèque Scientifique Internationale. Bailliére, Paris, 1876.
8. GEORGE P. FIELD. Tinnitus Aurium. Henry Renshaw, London, 1875.
9. SAMUEL THEOBALD. Tinnitus Aurium. Innes & Company, Baltimore, 1875.
10. JOSEF GRUBER. Ueber ein neues Verfahren zur Wegsammachung der Eustachischen Ohrtrumpete. *Genossenschafts-Buchdruckerei*, Wien, 1875.
11. H. B. HEWETSON. Rupture of the Right Membrana Tympani during an Attack of Vomiting. *London Lancet*, Sept., 1875.
12. GEORGE P. FIELD. A New Form of Artificial Membrana Tympani. *British Med. Journal*, June, 1875.
13. A. H. BUCK. Instrument for Application of Nitric Acid.
14. HAGEN and STIMMEL. Die Untersuchung des Ohres im polarisirten Lichte. *Berliner Klinische Wochenschrift*, No. 48.

1. FOLLOWING the suggestions of Rüdinger, Dr. Utz has entered into a more thorough investigation of the structure of the membranous semi-

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circular canals of the human labyrinth, and has published the same in a handsome monograph illustrated by photo-lithographic plates.

The principal object of the work has been a careful study of the structures occurring in this organ, termed papillæ by Rüdinger, with the object of determining, so far as possible, their nature, whether normal or pathological. The subject treated is the more interesting that the physiological experiments instituted by Flourens and followed by Harless, Goltz, Mach, Bruer and others, have led to the conclusion that the membranous semicircular canals are an organ of equilibrium.

Schiff and latterly Boettcher are of contrary opinion, the latter believing that the greater part of the symptoms observed by Goltz are the result of injury consequent on the method of operation, and that the assumption that the semicircular canals constitute a special organ of equilibrium is not supported by the facts in the case. As compared with the numerous experiments concerning the physiological value of the membranous semicircular canals, the works which treat of the anatomical, the histological structure of these organs are few in number. Of these the principal are the investigations of Rüdinger\* and of Lucæ.† The former is of the opinion that the papillæ in question are normal structures, and supports this view on the ground of their constant presence in the semicircular canals of all adults. The latter supports this statement, but believes Rüdinger's inference to be a mistake, and that the papillæ are really pathological, because they are not found at all ages, because they lack the epithelium which is found on the whole of that part of the inner surface of the canal which is wanting in papillæ, and because the isolated papillæ give the recognized amylin reaction with iodine. In a latter communication Rüdinger denies the absence of epithelium, and remarks with regard to the reaction with iodine that this is also peculiar to other structures in which amylin has not yet been detected. Voltolini has also investigated these structures and considers them enlargements of the epithelium.

Following these remarks, which form in part a preface to the work, the author gives first the method of examination. The structure of the semicircular canals, the various coats and their relations to each other, and especially the number and size of the papillæ, are best shown on cross sections, as recommended by Rüdinger. The preparation of the specimen for microscopic examination consists first in soaking the temporal bone in alcohol for several days. The removal of the membranous canals is

\* Das häutige Labyrinth. Handbuch der Lehre von den Geweben. Stricker, 1871.

† Ueber eigenthümliche in den häutigen halbzirkelförmigen Kanälen des menschlichen Ohres vorkommende Gebilde. Virchow's Archiv, Band XXXV.

more easily effected, and they are in better condition to afford good cross-sections. They should be removed and preserved as far as is possible *in continuo*, as it is very important to be able to identify the portion of the canal from which the section is taken. After removal, the canals must remain in alcohol long enough to secure the degree of elasticity and resistance necessary to preservation of their form after section. The sections should be made by means of fine scissors, as nearly as possible at a right angle to the long axis of the canal, and in fluid (preferably alcohol), which will allow the canal to resume nearly its normal form after section, and will avoid the changes resulting from continued pressure which might lead to error.

The prepared sections are mounted in glycerine. The following chapter is devoted to general description of the structure and position of the membranous semicircular canals, and a separate heading is given to the more minute description of the three coats, the outer or connective tissue coat, the middle coat or tunica propria, and the inner or epithelial coat. The sections on which these descriptions have been based are preferably those of new-born infants, in which no papillæ are found, according to the author, although Lucae claims to have met with them, and considers otitis media in the new-born infant a principal cause of the occurrence of these structures. Among the specimens examined by Utz were several from children who had suffered from this affection, but careful examination failed to detect the papillæ in any case. Under a high power the cross section appears as an oval ring with an irregular contour externally, resulting from the attachments to the periosteum torn away in removal of the membranous canal, the surface directed toward the free cavity of the osseous canal being smooth. Under a still higher power the three coats may be plainly distinguished.

The outer coat consists of connective tissue intermingled with numberless round or oval cells; there are also elastic fibres and numerous blood-vessels. It varies in thickness, being thinner on that portion of the canal contiguous to the bone, thicker on the free side of the membranous canal, and thickest at the point where the processes above mentioned pass into the periosteum. The resemblance of this coat to the periosteum favors the conclusion that this coat is simply the periosteum of the osseous canal, which at this point divides into two layers, enclosing the membranous canal between them. This view is further supported by a consideration of the development of the parts. In the embryo the whole osseous canal is filled with a gelatinous mass permeated by blood-vessels; in this, on the convex side of the osseous canal, the membranous canal is embedded. The gelatinous mass gradually

disperses, openings appearing in it, which enlarge until finally there remain only the periosteum, the outer coat of the membranous canal, and in addition a few bands of connective tissue which surround the blood-vessels passing between the periosteum and outer coat of the canal.

Before the entire recession of the gelatinous mass is completed, the bands of connective tissue are very numerous and so united as to form a delicate net-work throughout the mass.

Where the periosteum divides to surround the membranous canal there are large openings containing the principal blood-vessels, which send off lateral branches to the sides of the canal. The rounded cells, which are apparent in the periosteum and in the connective tissue, especially numerous on the free side of the canal, might, from their resemblance to epithelial cells, lead to the belief that the periosteum and outer coat of the canal possessed an epithelial covering, but careful examination does not support this view.

The second or middle coat, the transparent vitreous, tunica propria, can only be satisfactorily studied on cross-section, and then appears structureless, transparent, and colorless. The transverse marking which Lucæ observed in this coat, the author observed only in such preparations as were insufficiently hardened, and he believes them, therefore, to be merely accidental. The tunica propria varies also in thickness, and its outline is clearly distinguishable from that of the outer coat. The observation of Kölliker, that after treatment with acetic acid numerous cells appeared in the tunica propria, is not supported by the author, and his explanation of this phenomenon is that the swelling of the parts after action of the acetic acid, by confounding the boundaries of the two coats, led to this appearance. The inner surface of the tunica propria is covered by the third or epithelial coat, presenting the characteristics of pavement epithelium. The single cells are small, nucleated, and packed closely together, and so intimately connected that in some places they may be raised from the subjacent tissue like a separate membrane. In its later development the tunica propria presents marked changes, not in its structure, which remains the same, but in the form of the surface directed toward the cavity of the membranous canal.

This surface, which in the new-born infant is perfectly smooth, loses this characteristic in children of even a few months; it is then irregularly rugose, especially on the free wall of the canal. The earliest age at which this appearance was noticed was four and a half months. In older subjects it was still more marked. In a male sixteen years of age the papillæ presented all possible forms, and increased in size and number proportionately with the age of the subjects examined.

Their character and structure correspond exactly with that of the tunica propria, from which they project, and with which they are identical. They are colorless and transparent, and sharply outlined on the surface directed toward the cavity of the membranous canal.\* The opinion which has been advanced, that there is a boundary between the tunica propria and the papillæ, is explained by Utz. In a thin section there is not one row but several rows of papillæ one behind the other, separated by a depression in the surface. The bottom of such a depression appears, on profile view, as a line, seen through the transparent bases of the papillæ and simulating a division between the papillæ and the tunica propria. The papillæ are not distributed equally throughout the canals, but vary in size and number in different locations. On the upper surface, that portion of the canal contiguous to the bone, where the tunica propria is the thinnest, they never occur.† On the free wall they are well developed in size and number in adults, but the author has never found them in any case under sixteen years of age; they are largest and most numerous on the lateral walls of the canal. They develop first in the middle of the canal, considered as a whole, and progress toward the two ends, so that in a male six years of age the middle of the canal showed well-developed papillæ, while the two ends were free. In the adult also they are larger and more numerous in the middle of the canal and occur on all three walls, while at the beginning and end of the canal they are smaller, less numerous, on the free wall are almost wanting, and on the lateral walls so united as to be barely distinguishable. General affections, as well as special disease of the ear, seemed to have no influence on the occurrence of the papillæ. The specimens examined by the author were taken from persons who had suffered from various acute and chronic disorders, and in no case was a variation from the usual development of these structures observable. The examination also of the semicircular canals of a deaf mute revealed the same general appearances. In the chapter on the epithelium of the inner wall in the adult, the author reviews the statement of Lucæ that the tips of the papillæ are free of epithelium, explaining it on the ground that the epithelial layer, as already stated, is easily raised from its subjacent tissue, and the appearance described by Lucæ may be, therefore, the result of mechanical interference in preparation. Utz therefore concludes, from the constant occurrence of the papillæ in all adults, from their regular distribution throughout the canals, and from their development, which

\* Lucæ denies this sharp outline to all the papillæ. Utz maintains that it is always observable in successful sections.

† The so-called papillenfreie Wand of Rüdinger.

may be progressively studied, that they are normal structures, and, as regards their physiological import, without reference to either of the two theories concerning the office of the semicircular canals, that the papillæ serve to modify the movement of the endolymph in the membranous semicircular canals.

II. The comparatively rare opportunity afforded for examination of the Eustachian tube of the elephant has induced Dr. ZUCKERKANDL to record his observations, although unfortunately only a portion of the subject could be obtained, sufficient however to form the basis for a very interesting communication.

The ostium pharyngeum tubæ is with difficulty found, as there is no projection on the pharyngeal wall to mark its position. The passage is very nearly vertical, and diminishes regularly in size from below upward throughout the portion examined, about two-thirds of the whole length of the tube. The ostium pharyngeum possesses no distinct cartilaginous boundary, but appears as an irregular and comparatively small slit, the thick lateral wall of which is considerably longer than the medial membranous side. Longitudinal sections made at various points in the tube show that near the pharyngeal end the lateral is much stouter than the medial wall; that the summit of the tube is embraced in a very resistant tissue, and that the medial wall increases rapidly in diameter laterally, while the lateral wall correspondingly diminishes.

The increase in thickness of the tubal cartilage is especially noticeable in the lower portion of the medial plate; this increases to a cylinder, which nearly surrounds the tube in its middle portion. The tube is fixed to the base of the skull by a comparatively slender basilar fibro-cartilage, which leaves the medial wall nearly free. The condition of the specimen unfortunately made it impossible to determine the anatomical characteristics of the cavity of the tube. The macroscopic structure of the tubal cartilage, however, presented considerable interest. It appears that only the apex of the tube possesses real homogeneous cartilage, which, in the shape of a groove, forms a portion of the medial and lateral walls; the remaining and by far longer portion of the tubal cartilage comprises three varieties, alternating and commingling. Primarily noticeable in the more or less fibrous matrix is an irregular network of fibres of varying size, frequently anastomosing, and connected with the apex of the tube. The peripheral walls of this cartilage network are bordered by delicate white lines which form separate islands, as it were, on cross-section of the tube. The substance interlying the above-named tissues is more of a reddish-yellow color, presents a fibrous appearance, and is not so resistant as the hyaline tissue.

Microscopic examination shows that the various forms of cartilage tissue participate in the structure of the tube. Those portions which present the appearance of a hyaline cartilage are in fact formed partially of a structureless basis, thickly strewn with cartilage cells.

Other parts exhibit a meagre and delicate fibrous tissue, which extends beyond the boundary of the cartilage into the surrounding tissues. The soft, reddish-yellow tissue above described as interlying and surrounding the cartilage structures, and which receives numerous bundles of connective fibres from the white cartilage, is a cell-less connective-tissue cartilage, marked with a confusion of intermingling fibres.

III. In reply to the papér of Prof. Moos on dilatation of the bulb of the jugular vein, in which he traces a connection between such dilatation and psychical affections, RÜDINGER has published some observations. Out of one hundred human skulls Rüdinger found that in sixty-nine the right jugular foramen was the larger, in twenty-seven the left, and in four the two were equal. These results, except in the last point, correspond very fairly with those obtained by Dr. Dwight from a series of one hundred and fifty-nine skulls, of which one hundred and four had the foramen larger on the right, thirty-eight on the left, and seventeen presented no difference. Rüdinger shows that the difference between the two sides depends on the arrangement of the venous sinuses. He holds that there is no true confluence at the internal occipital protuberance, but that the superior longitudinal sinus carrying the blood from the surface of the hemispheres turns to the side of the larger foramen, usually the right, and that the straight sinus from the interior of the brain turns the other way. He admits, however, that there is a communication between the two.

Rüdinger's conclusions are :

1. That the jugular openings are unequally large and deep.
2. That this difference is not the result of any anomaly of the surrounding bones.
3. That, as above stated, it depends on the course of the circulation.
4. That a broad jugular fossa appears to be an individual peculiarity, in which neither the intra-cranial circulation nor the function of hearing is concerned.

IV. Dr. DWIGHT, in addition to the above review, says that he is unable to see on what the last conclusion is based, as his own observations show that of the one hundred and forty-two skulls which had the foramen larger on one side than on the other, ninety-three, or nearly two-thirds, had a more capacious fossa on the side corresponding to the larger foramen, while the fossa was larger on the side corresponding to the smaller foramen in only nineteen, or less than one-seventh.

V. A further contribution to the knowledge of the movements of the Eustachian tube is furnished by Dr. NICOLADONI in a case coming under his observation. The favorable opportunity for examination, and the previous progress on the same subject by Zaufal,\* Zuckerkandl,† and others, render the case particularly interesting.

The patient, twenty-one years of age, had suffered for three years from difficulty of breathing through the right, latterly also respiration through the left nostril had become impaired. The configuration of the upper jaw had become somewhat changed. The right canine fossa had become obliterated, the lower rim of the right orbit projected, the nose was turned toward the left, and there was a slight exophthalmus. Under the mucous membrane of the right cheek was a tumor the size of a nut, readily movable, and fixed posteriorly. The row of upper teeth on the right side was pressed toward the median line, so that the arch of the alveolar process seemed more flat than normal. The soft palate was pressed forward, and on sounding the vowel *a*, as the palate lifted the lower border of a tumor of a rose-yellow color was revealed. Examination with the finger showed the whole naso-pharyngeal cavity to be filled by a smooth, lobulated tumor, free anteriorly, posteriorly, and toward the left side of the cavity.

The septum marium was pressed toward the left, so far indeed that the left nasal passage was represented by a slit from 2<sup>'''</sup> to 3<sup>'''</sup> wide.

This tumor hung from the right pterygoid process and the anterior portion of the right pharyngeal wall, and so filled the right nasal passage that it was possible to introduce a probe only by closely hugging the wall of the septum. The operation consisted in removal of the right upper jaw, leaving the palatine and alveolar processes.

After removal of the facial surface of the upper jaw with a portion of the tuber maxillæ superioris, a tumor lying within the antrum of Highmore coming away with it, a view was obtained of the right nasal cavity greatly enlarged, its anterior portion filled by a long fibrous tumor, the wider posterior portion being crowded by the principal mass of the tumor attached to the right pterygoid process by a broad base. The tumor was peeled away from the process and cut from the right pharyngeal wall with scissors, the bleeding, which was considerable, being checked by

\* Zaufal. Besichtigung der Pharyngealmündung der Eustachischen Röhre durch die normale Nase. Aertzl. Correspondenzblatt, No. 24.

Die normalen Bewegungen der Rachenmündung der Eustachischen Röhre. Archiv f. Ohrenheilk., B. ix. 4, 3-4.

† Zuckerkandl. Zur Anatomie und Physiologie der Tuba Eustachiana, Monatsschr. f. Ohrenheilk., II, 1874.

actual cautery. The tumor in the cheek was laid bare and followed to its base on the right pterygoid process, from which it was removed; it was of fibrous structure, and at its insertion of a loose porous tissue from which a quantity of dark blood was pressed.

After removal of the pharyngo-nasal tumor, which was about the size of a hen's egg, the enlargement of the right nasal fossa was exhibited, and advantage of the opportunity was taken to observe the movements of the Eustachian tube, the septum being pressed so far to the left that with good illumination it was possible to observe the whole of the left pharyngeal wall.

Simultaneously with the contact of the soft palate with the posterior pharyngeal wall, its posterior surface being almost in a line with the floor of the nasal cavity, the medial portion of the tube, about one centimetre in height, began its movement while the lateral portion appeared to remain at rest. The movement, which was rather rapidly performed, consisted in an elevation for about three millimetres of the lower prominent edge of the medial plate, which appeared also to be drawn backwards and slightly toward the median line, at the same time the lower boundary of the fossa of Rosenmüller became sharply marked and projected into the pharyngeal space, an arcus alpingo-pharyngeus, the apex of the tube, remained at rest. Blood accumulating on the left wall of the pharynx, and a bubble occurring over the opening of the Eustachian tube, it was interesting to notice that with each movement of swallowing the bubble sank into the depth of the Eustachian tube to reappear at the termination of the act of deglutition. The review had opportunity to make a somewhat similar observation in a case in which the membrana tympani having been destroyed, and a thin and lax cicatrix having formed across the anterior portion of the tympanic cavity, cutting of all communication between the air in the remaining posterior portion of the tympanic cavity and that in the Eustachian tube, deglutition was accompanied by a movement of this cicatrix. At the commencement of the act of swallowing the lax cicatrix was forcibly extended, maintaining this position until the act was completed, when it sank back to its former place.

VI. Another case affording opportunity for investigation of the movements of the faucial portion of the Eustachian tube is added by MICHEL to those which he has already reported.

The patient, a young man twenty years of age, had suffered for thirteen years from disease of the nasal cavity, resulting in destruction of the septum. The removal of a large sequestrum exposed the whole of the naso-pharyngeal cavity; the orifices of both Eustachian tubes and the whole of the soft palate were plainly visible.

On swallowing, the whole of the posterior surface of the soft palate came into view, pressing laterally between the cartilage projections of the Eustachian tubes and posterior boundary of the nasal cavity into the openings of the Eustachian tubes, and rising convexly against the posterior pharyngeal wall.

Simultaneously the projections of cartilage were elevated, their lower borders approaching the centre of the cavity of the pharynx; while behind them, on the posterior pharyngeal wall, appeared two projections rising from 1 to  $1\frac{1}{4}$  cm. above the surface of the palate and having a smooth surface 1 cm. wide between. On forcible deglutition this intermediate space disappeared and the mucous membrane presented additional folds. During phonation the appearance was much the same, except that a thick fold appeared on either side at the junction of the posterior and lateral pharyngeal walls. On sounding the vowel *a*, the palate was nearly flat, rising but little above the level of the floor of the nasal cavity; with *e*, *i*, *o*, and *u*, however, it was elevated considerably above that level.

The anterior border of the Eustachian opening remained nearly motionless, except that below it there appeared a slight fold\* which was lost in the border of the palate, moving backward and forward during the act of swallowing. In order to study the movements of the Eustachian opening a mirror  $1\frac{1}{2}$  cm. in diameter was passed through the nasal passage and the speculum passed upon it. When at rest the opening appeared as a furrow, the lower portion of which formed a triangle, the walls above lying in contact. The act of swallowing was accompanied by a wave-like motion on the floor of the orifice, then an elevation, the floor of the tube rising into the opening; and at the height of the act, the moment of greatest elevation of the floor, the furrow opened, presenting the appearance of a dark triangle, the apex of which was lost in a black line extending upward.

During phonation the cartilage projection of the tube moves backward, and its lower border is elevated by the upward pressure of the floor. The orifice opens only during singing of the high *i* or *e*, as with these vowels the palate is forcibly elevated and the floor of the Eustachian opening passed upward. On sounding these vowels both the cartilage projection and the velum vibrate forcibly, and the transmission of these vibrations to the osseous portion of the tube and to the ear may explain in great measure the singing sound heard on sounding and holding the high *i*.

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\* Plica salpingo-palatina of Luschka.

The cracking sound sometimes heard on swallowing may also be explained by the movement of the cartilage of the tube.

VII. One hundred and four out of the two hundred and fifty-eight pages of the work of Prof. BERNSTEIN are devoted to sound and hearing. The work as a whole is more thorough, and at the same time better suited to the comprehension of the general reader than are most of the rapidly multiplying books of this class. It is also clearly printed and well illustrated.

As a popular rather than a purely scientific work it would be out of place to present an intimate review of the several chapters devoted to the sense of hearing. The author's views in regard to the physiological value of different portions of the auditory apparatus, and comparison with the views of other writers, are clearly stated in language appropriate to a work of this kind, and enough is given of the minute anatomy of the ear to make the functional importance of the various structures clear to the reader.

VIII. The first part of Mr. FIELD's paper, as read before the Harveian Society, is devoted to a definition of the term tinnitus aurium, to quotations from various authors, ancient and modern, as to its causes and importance as a symptom, and to an enumeration of various remedies, empirical or otherwise, which have been suggested for its relief. "I think," the author says, "the mischief can always be traced to the membra tympani. We rarely find tinnitus present in cases of perforation from ulceration, and incising the membrane no doubt will afford relief if a permanent opening can be established." When remedies applied to the removal of the supposed cause of the tinnitus aurium have proved inefficient, the author has employed Faradization, which he has rarely found to fail.

"In point of fact I have no hesitation in saying that Faradization applied directly to the tympanic membrane will either materially relieve the patient from the noise he has been suffering from or stop it altogether."

"With reference to electricity as a remedy for severe noises in the ear, I maintain that the good effect I have obtained is due to the stimulation of the intrinsic muscles of the ear, just as in other parts of the body paralysis is often overcome by the same means."

Seventeen cases are mentioned in which tinnitus aurium, more or less severe, disappeared after Faradization for a longer or shorter period. There is no detailed statement of other symptoms, and only a superficial description of the objective symptoms in any case. The author's investigations have been limited to the boundary of the lines in Hinton's appendix to Toynbee's work: "It seems better that the causes of tinnitus should be held as yet a very open question." His views as above given are submitted to the judgment of the reader.

IX. Dr. Theobald, on the other hand, enters into "a consideration of the causes upon which tinnitus aurium depends, and an attempt to explain its production in accordance with physical principles." The author goes still further than does v. Tröltzsch, and says not only that subjective sounds in the ears are an expression of irritation of the auditory nerve, but that they are an expression of an excitation of the terminal or percipient elements of the auditory nerve only and not of irritation of the nerve trunk. Tinnitus aurium is to be attributed in almost all cases, whether associated with aural affections, cerebral diseases, or constitutional disorders, to the existence of vibrations excited in the walls of the blood-vessels of the labyrinth by the friction attending the circulation of the blood.

The author's conclusions are, that the two modes by which the vibrations of the vessels of the labyrinth may be enabled to produce a sensible impression upon the auditory nerve are by increase of the amplitude of the vibrations, and the amplitude of the vibrations remaining unchanged by the increase of their effects upon the nerve, by reflection, concentration, or by resonance; in other words, the circulation in the blood-vessels of the labyrinth being the cause of the subjective noises, they may be increased so far as to become perceptible by any undue friction attending the movement of the blood, and this will happen when the normal relationship between the intra-vascular and intra-labyrinthine pressure is disturbed, or when, in any other way, the natural flow of the blood is perturbed, or by any change in the sound-transmitting portions of the ear which will return the sonorous vibrations resulting from the intra-labyrinthine circulation of the auditory nerve. "Those conditions of the sound-conducting apparatus which prohibit the entrance of sounds from without will also prevent the escape of sounds from within." The tinnitus accompanying catarrhal inflammation of the middle ear is explained on the above ground, and by the added effect which the accompanying intra-labyrinthine pressure may have upon the circulation.

X. A new method for inflation of the middle ear, recommended by Gruber, consists in a modification, or rather combination, of the use of the ordinary air douche and the Valsalvian experiment. The object being, where it is desirable, to dispense with the use of the catheter to close the upper portion of the pharyngeal cavity from below, and produce a pressure in the naso-pharyngeal space which shall extend to the middle ear. This may be accomplished by substituting for the act of swallowing the intonation of certain syllables or consonants which are accompanied by forcible elevation of the posterior portion of the tongue pressing the soft palate upward and backward against the posterior pharyngeal wall.

This movement is most pronounced on sounding the consonant *k* without the accompanying vowel sound. Simultaneously with the sounding of *k*, or, better still, *hk* by the patient, air is forced into the nostril by means of the balloon in the usual manner. By interposition of a vowel sound between the *h* and *k* closure of the naso-pharyngeal space is more effectual, and by interposing *a*, *e*, *i*, *o*, and *u* in succession, as, for instance, *hack, heck, hick, hock, huck*, the backward pressure of the tongue is effected in a regularly increasing ratio. By the use of these syllables a measure of the degree of pressure is therefore obtained, and by inclination of the patient's head to one side or the other, the air is forced into the ear which is uppermost.

XI. An interesting case of rupture of the membrana tympani is reported by Mr. HEWETSON, and is worthy of notice from the peculiar circumstance of its occurrence.

The patient, a man forty-eight years of age, applied for relief from deafness and severe tinnitus aurium. Inquiry elicited the fact that some four months previously the patient suffered from an unusually severe attack of vomiting, immediately following which he found that he could not hear his watch in the right ear, the hearing of which had always been previously good. On examination a small dark spot was discovered on the right membrana tympani midway between the long process and anterior edge of the membrane.

Air forced into the middle ear gave no perforation sound, but after syringing with warm water, inflation was accompanied by a sharp, hissing sound, and the dark spot, freed of the slight accumulation of secretion, exhibited a ragged opening, the edges of which were everted by the steam of issuing air. Tepid instillations of a solution of the bicarbonate of soda, followed by use of a three-grain solution of sulphate of zinc, resulted at the end of a week in closure of the opening, and consequent improvement in the hearing. It would have been interesting in the above case to have determined the comparative potency of the two Eustachian tubes, as the rupture was evidently the result of the sudden intra-tympanic pressure consequent on the forcible vomiting.

XII. Mr. FIELD proposes a modification of the Toynbee artificial membrana tympani, which shall make that instrument available for the application of medicated solutions. It consists in extending the wire one-quarter of an inch beyond the rubber membrane, and attaching a disc of fine flannel, between which and the rubber may be packed surgical cotton saturated with the medicated solution. The author claims for this instrument that the flannel gives the requisite pressure, the rubber assists vibration, and the cotton will allow of the continued application of any

remedy which the case may demand. The same objects have been attained in the experience of the reviewer by the simple use of surgical cotton properly moulded and packed.

XIII. An ingenious and at the same time a very simple method for application of nitric acid in cases of granulations occurring in the middle ear or auditory canal has been devised by Dr. Buck.

One of the difficulties attending the use of this acid, when applied on the cotton-tipped probe, has been the liberation of vapor within the canal, obscuring the view, and interfering with the proper application of the acid. This is obviated by using a small glass tube, in which runs a platinum wire. The wire, tipped with cotton and dipped in acid, is withdrawn within the glass tube, the end of which is then pressed upon the spot to be cauterized, and the wire pushed forward. After the operation, the office cotton may be removed from the wire by burning.

XIV. Incited by the interesting and successful experiments of Prof. Coccius on the examination of the eye in polarized light, Drs. HAGEN and STIMMEL have applied the same method of examination to the ear. The apparatus employed for the purpose consisted of a plane mirror of  $13''$  Par. diameter, having a central opening of  $3''$  Par. diameter, placed between two Nikol's prisms, each of which, surrounded by cork, was contained in a brass case. The mirror was surrounded by a metal ring having joints at two opposite points, one of which united the mirror with the metal case of the large Nikol prism, and allowed the mirror to be placed at various angles to the large prism. The opposite joint united the mirror to the smaller metal case of the second prism which was placed behind it. The case was set obliquely from left to right in such a position, that the smaller prism, with each change in position of the mirror, could be placed vertically to the central opening of the latter. The smaller prism, furthermore, was movable in its metal case, so that, during examination, its plane of polarization could be placed at right angles to the plane of polarization of the larger prism. The authors also found it of advantage to add a ball and socket joint at the lower portion of the ring holding the mirror for attachment of a twelve-inch convex lens. By placing this lens over the face of the mirror, the latter was converted into a concave mirror of six inches focus, and, by placing the lens behind the mirror, it served to enlarge the picture, while, in order to examine with the mirror alone, it was only necessary to turn the lens downward. The strong illumination necessary for this method of examination was furnished by a Tobold lamp. The lamp was placed at the left of the observer at the height of the ear under examination, and in such position that the column of light passed close to the ear at right

angles to the long axis of the meatus. An ordinary speculum was placed in the ear and held by an assistant. With the left hand, the larger prism was placed at a distance of about half an inch from the opening of the Tobold lamp, while the right hand seized the smaller prism placed behind the mirror, and set the latter at an angle of about  $45^{\circ}$  to the larger prism. The instrument was held nearly horizontal, so that the light from the lamp, passing through the larger prism or polarizer, fell upon the mirror and was reflected into the ear. On examination, under these circumstances, the ear presented the usual appearance, but, on placing the smaller prism or analyzer behind the mirror, and bringing its plane into position by turning the metal case, the effect of polarization was produced, the light returning from the membrana tympani through the opening in the mirror passing through the analyzer before reaching the eye.

Under these circumstances the following changes in the appearance of the membrana tympani are observed: The delicate lustre which overspreads the normal membrana tympani is wanting; the light reflex disappears; the location of the light reflex, however, is of a bluish-white color, and somewhat lighter than the adjacent parts; the explanation of this is probably that the light rays returning from this portion of the membrana tympani are largely absorbed by the polarizing mirror; other light spots upon the surface of the membrana tympani, and the reflections from fluids in the meatus or on the membrana tympani, also disappear.

Transparent portions of the membrana tympani, moreover, may apparently be made entirely to disappear. A very common condition was the entire disappearance of the posterior superior segment, rendering the long process of the incus and portions of the stapes and promontorium visible. Other portions of the membrana tympani presented the appearance of a delicate veil. It was also possible to determine the presence of adhesions and pseudo-ligaments in the tympanic cavity. All opacities of the membrana tympani, such as calcareous deposits, ecchymoses, and the like, appear more distinctly defined, and the blood-vessels of the manubrial plexus were more clearly visible.

Enough has been done, as shown by the above short review of the results arrived at by the observers, to demonstrate the advisability of further experiment upon the use of polarized light in examination of the ear; and the suggestions thrown out in their paper as to examination of the movements of the ossicula and of morbid appearances, such as serous or purulent accumulations within the middle ear and the various forms of opacity of the membrana tympani, point to a larger application of this means of illumination than that of a simple experimental test.

